PROJECT DESCRIPTION

There are many contaminated sites in downtown Santa Barbara due to leaking underground storage tanks, former dry cleaner, industrial solvent release sites, and other land uses. This contamination threatens drinking water aquifers, surface water, and public health. This project will build on existing information to document the regional geology and hydrogeology, fate and transport of pollutants throughout the basin, and identify those areas that pose the highest risk to human health and the environment. This information will be used to prioritize cleanup of sites in these high risk areas. This project will also identify if ongoing monitoring is adequate to track existing pollution and protection to drinking water and surface water by developing a basin conceptual model to assess receptor locations, potential pathways, and existing contaminant plumes. An action plan will also be developed to address pollution that cannot be assigned to a responsible party that will identify the regulatory agency responsible for implementing action plan elements. The results from this project will be essential to the City for development of a Ground Water Management Plan. Finally, this project will lead to more engagement between agencies and more data sharing at a local level. These are complex systems (geology, hydrogeology, land use, pollutants) and can be well managed at a local level with all stakeholders involved.

The Project Description contains two sections: 1) background, which includes information on the history, current land use, water resources, regulatory oversight of site assessment and cleanup, existing information regarding soil and groundwater pollution, conceptual site models, how this project relates to the Integrated Regional Water Management Plan (IRWMP), and the purpose and need for the evaluation; and 2) project description, which includes a discussion on the need for this project, the goal of the project, prioritization of cleanup projects, benefits, relationship to groundwater management planning, interagency collaboration, and stakeholder involvement.

Background

This section provides the background and context for this local groundwater assistance (LGA) Grant application. The focus of this project is the downtown area of Santa Barbara which is generally bounded to the southeast by the Pacific Ocean, northeast by Milpas Street, northwest by Mission Street, and southwest by San Andres/Loma Alta Drive (See Figure 1). This area was selected because it has the highest density of residential and commercial properties, the highest density of contaminated sites, and includes five of the City's production wells (not shown for confidentiality purposes. Included in this section is a discussion on historic and current land uses, regulatory responsibilities, and the nature of threats to public health and environmental resources.

History

The City of Santa Barbara (City) occupies a narrow coastal plain between the Santa Ynez Mountains and the Pacific Ocean. Santa Barbara has been a thriving community since the early 1900s, drawing people because of its Mediterranean climate and due to the availability of various economic opportunities throughout the last century (e.g., petroleum development, fishing, aerospace, film, education and tourism). In general, the City has a high density, mixed-use downtown area with commercial/residential areas to the east, residential areas to the west, the ocean to the south, and residential to the north. In the last 80 years, land uses in the downtown core and east side have evolved from mixed use commercial (including industrial uses such as dry cleaners, mechanic/autobody shops, metal fabrication, electronic component manufacturing facilities, and manufactured gas plants) and other light manufacturing. Current

and prior land uses have left a large number of sites with soil and water contamination from chlorinated solvents, fuels, and other hydrocarbons as well as heavy metals.

In 1925, an Earthquake devastated the City, and much of the earthquake rubble was used as fill material in the "Old El Estero" estuary/lagoon area on the eastside of the City[1] and a large area south of Highway 101. (See Figure 2 for the location of the Old El Estero). According to a recent study of the Old El Estero fill area, a large portion of the fill is thought to be mostly concrete, wood, glass, metal, and small quantities of household trash[2]. Elevated metals concentrations, including high concentrations of lead, have been detected in the fill materials, but not in shallow groundwater. There are elevated levels of total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) in shallow groundwater, but these are generally associated with underground fuel tanks or surface discharges from former industrial sites constructed on the fill.

Current Land Use

Current land use is shown in the Santa Barbara General Plan Figure 3. The downtown area (along State Street is occupied by high density commercial buildings with substantial office space. To the east of the downtown area land uses are dense and predominantly comprises mixed residential and commercial with commercial and light manufacturing dominating between State Street and Milpas Street. Most properties range in size from 5,000 to 25,000 square feet. While some commercial operations are new, many are well established and have occupied the same buildings for decades.

Water Resources

The City of Santa Barbara is located in a coastal desert with a semi-arid climate (receiving approximately 17 inches of rain per year[3]). Providing adequate water supplies has been a challenge throughout the City's history. As stated in the 2007 Integrated Regional Water Management Plan (IRWP), the effective management of water resources is one of the key challenges facing Santa Barbara County; this continues to be an ongoing concern to the City. In particular the City must carefully manage its water supplies to meet the needs of its customers throughout long periods of drought. Accordingly the City manages or benefits from several sources of supply including: Gibraltar Reservoir, Creek Mission Tunnel infiltration, Lake Cachuma, State Water, groundwater from City Production wells, and (in time of severe drought) desalination. The City provides water service to most properties within the City limits, with a population of about 94,700.[4]

The City pumps most of its groundwater from the Santa Barbara and Foothill groundwater basins. The Santa Barbara basin is subdivided into two storage units: Storage Unit 1 and Storage Unit 3. The City solely manages its groundwater supplies through its "Pueblo water

[1] The Old El Estero area extended from the coastline northwestward up to approximately Canon Perdido or Carrillo Streets. In the area south of the current location of Highway 101 the El Estero marshland extended from approximately Garden east to Salsipuedes Street (Calle Cesar Chavez).

[2] Geosyntec Consultants. *Historical Research Study and Data Review for the Old El Estero Fill Area at Garden and Montecito Streets*, February 25, 2010.

[3] Martin, P. Ground-Water Monitoring at Santa Barbara, California: Phase 2-Effects of Pumping on Water Levels and on Water Quality in the Santa Barbara Ground-Water Basin. U.S. Geological Survey Water-Supply Paper 2197, 1984.

[4] City of Santa Barbara Annual Water Quality Report http://www.santabarbaraca.gov/NR/rdonlyres/270BAF10-7A21-4069-8219-8B91FFFC57EA/0/WaterQualityNewsletter52212.pdf June 2012.

rights."[5] Its groundwater supply is developed from aquifer units located beneath various areas of the City. Those located beneath the downtown and east side are deep but may be susceptible to migration of contamination. Contamination has reached deeper aquifers in other locations and this adversely affects municipal supply wells.

Geology and Hydrogeology

Downtown Santa Barbara lies in a southeast facing coastal valley filled by alluvium. The alluvium is up to 300 feet thick and thickens to the south where it extends beneath the Santa Barbara Channel. Lower portions of the alluvium beneath the downtown Santa Barbara area is predominantly comprised of a confined aquifer defined as Storage Unit 1 by the United States Geological Survey (USGS).

Shallow Groundwater

The depth of first encountered groundwater in the City ranges from near ground surface at the ocean to approximately 50 feet or more below ground surface on upper State Street. The direction of shallow groundwater flow beneath the downtown area is generally toward the former El Estero estuary on the southeast end of Laguna Street (at U.S. 101). Shallow groundwater southwest of Laguna generally flows to the east, and groundwater northeast of Laguna flows to the southwest. Locally, there is considerable variability in the direction of groundwater flow in the shallow groundwater zone (SZ).

The SZ is defined as alluvium occurring between land surface and the top of the upper producing zone (UPZ). The SZ ranges in thickness from less than 100 feet south of Mission Ridge Fault to approximately 300 feet near the ocean. The SZ generally consists of relatively low-permeability sand, silt, and clay, and has been divided up into at least five water bearing sub-zones that are generally laterally discontinuous. The fine grain material of the SZ confines or partially confines the UPZ.[6] The UPZ consists of a continuous layer of medium to coarse sand with some fine gravel ranging in thickness from less than 10 feet to approximately 50 feet.[6] It is unclear from available information and descriptions of the regional hydrogeology as to where partial confinement of the UPZ occurs.

City Supply Wells

City groundwater supplies are produced from two subbasins: Storage Unit 1 (downtown area) and the Foothill Basin (outer State Street area). The City has six wells in the downtown area, and three in the outer State Street area, and all are screened in the UPZ. A majority of contaminated sites overlie Storage Unit 1 and is therefore the focus of this study.

Municipal pumping wells do not draw water from the SZ interval in Santa Barbara. The City manages its water supplies to rely on groundwater more heavily during prolonged droughts. Currently, the City pumps a relatively low volume of groundwater from a few downtown wells, and downward hydraulic gradients are not generally observed between the SZ and the UPZ. However, solvents have been detected in some of the City wells near cleanup sites. If pumping rates increase, downward hydraulic gradients (with increased potential for downward transport of pollutants) could occur, as they have in past years when the City pumped more rigorously. Regulatory agencies and the City Water Resources Division last met in 2006 to develop a list of sites near pumping wells, but have not actively exchanged data recently, except on a few high priority sites near their water supply wells. At the time, the City estimated the capture-zone

[5] A water right possessed by a municipality that, as a successor of a Spanish-law pueblo, is entitled to the beneficial use of all needed, naturally occurring surface and groundwater of the original pueblo watershed. http://www.swrcb.ca.gov/waterwords.html.

radius of their six deep pumping wells downtown to be approximately ½ mile in the downtown area.[6]

Surface Water
The Santa Barbara Basin is drained by Sycamore, Mission, San Roque, and Arroyo Burro Creeks. Prior to the development of Santa Barbara and the 1925 earthquake, a marshy lagoon (El Estero estuary) occurred between Santa Barbara High School and the ocean. The estuary was filled in, and a network of drains dewaters the area. Groundwater flow modeling indicates that a significant amount of groundwater discharges from the former estuary and ultimately to the ocean[7] via the drains. In association with the *City of Santa Barbara Storm Water Management Program* a GIS based map of all storm drains and creeks is available (See Figure 4).

Recharge Areas
Natural recharge in the basin is derived from infiltration of precipitation, seepage from streams, and subsurface inflow from consolidated rocks. Other recharge is derived from releases into Mission Creek from the Mission Tunnel, which brings water to the city from Gibraltar Reservoir[8].

Existing Models
The USGS Investigation Reports 86-4103[9] and 97-4121[10] provide a good synopsis of the regional hydrogeology of the Santa Barbara Groundwater Basin. Investigation Report 97-4121 describes the numerical groundwater flow model that the USGS developed (along with support from the City) to facilitate groundwater management in the Basin, including Storage Unit 3. See Figures 2 (plan view) "Location and General Features of the Santa Barbara Groundwater Basin", Figure 5 (cross section) "Cross Section A – A'" from the 86-4103 Report, and Figure 6 of the 97-4121 USGS Report for general figures and cross sections of the groundwater basin. In establishing parameters for the model, the USGS evaluated the geohydrology of Storage Unit 3 and developed a combined flow model of the Santa Barbara and Foothill groundwater basins. The report indicates that groundwater surfaces in the lower reaches of Mission and Arroyo Burro Creeks and the local areas serviced by manmade drains, including the former El Estero estuary. The models are regional in nature and will likely need to be supplemented/refined if used to evaluate local pollutant transport and threat to receptors such as creeks and municipal supply wells in the downtown area.

Regulatory Oversight of Site Assessment and Cleanup
Regulatory agencies, (including the Santa Barbara County Fire Department, Hazardous Material Unit, (Fire Department), Central Coast Regional Water Quality Control Board (Water Board), and Department of Toxics Substances Control (DTSC)), work cooperatively to provide technical and regulatory oversight for the investigation and cleanup of sites. In Santa Barbara County, the Fire Department's Leaking Underground Fuel Tank Program (LUFT) is the lead agency for underground storage tank (UST) cleanup sites. In accordance with Health and Safety Code

[6] Farr Associates, Letter: Comments on URS Corrective Action Work Plan, Mission Linen Supply, December 7, 2006.
[7] Martin, P., Ground-Water Monitoring at Santa Barbara, California: Phase 3- Development of a Three-Dimensional Digital Ground-Water Flow Model for Storage Unit I of the Santa Barbara Ground-Water Basin. Water Resources Investigations Report 86-4103, 1986.
[8] California's Groundwater Bulletin 118, Central Coast Hydrologic Region Santa Barbara Groundwater Basin.
[9] Martin, P. 1986.
[10] Freckleton, J.R. et al, Geohydrology of Storage Unit III and a Combined Flow Model of the Santa Barbara and Foothill Ground-Water Basins, Santa Barbara County, California. U.S. Geological Survey Water-Resources Investigations Report 97-4121, 1998.

(HSC), Section 25297.1, the Fire Department contracted[11] with the State Water Board to oversee investigation and corrective action of these sites.

The Fire Department's Site Mitigation Unit (SMU) has authority under HSC Section 25260/101480 for oversight of numerous soil and groundwater contaminated sites that are non-UST related. The non-UST sites represent all pollutants that are not released from underground storage tanks (and may include pollutants such as solvents, petroleum fuels, metals). For groundwater impacted sites, the Fire Department coordinates clean-up activities with the Water Board as needed. An Inter-Agency Agreement[12] states the Fire Department's SMU is the lead for soil-only investigations and cleanups, while the Water Board is the lead on non-UST sites that have (or threaten to create) groundwater impacts.

In Santa Barbara, DTSC is the lead regulatory agency on a few sites, mainly those near schools, sites with hazardous waste releases, and those with insolvent responsible parties that are a high risk to receptors.

These regulatory agencies typically deal with cleanups on a case-by-case basis because that is how the funding mechanism is set up for each regulatory agency. Due to limitations in the current program, there is no approach in place to evaluate how shallow groundwater pollution impacts the groundwater basin as a whole or how the relative risk of these sites compare to each other.

Many underground storage tank and groundwater cleanup sites (i.e., former dry cleaner and industrial solvent release sites) occur in Santa Barbara, especially in the downtown area (Figure 7). In fact, the downtown area of Santa Barbara has the densest area of active cleanup cases in the Central Coast region. In addition, there may be contaminant plumes with unidentified sources and/or responsible parties. The density of sites, local geology, hydrogeology, and nature of current land use result in significant challenges to successful site cleanup due to comingling and migration of pollutants. More importantly, these sites pose a significant risk to human health and exposure to a large population.

Legal Authority

The Fire Department's authority to oversee the assessment and mitigation of hazardous substance release sites and UST sites include, but are not limited to: Santa Barbara County Code Chapter 15, Article 7, California HSC Sections 25280-25299.8, 101480, 25200, and 25260 et. seq. (Site Designation Committee); and the 2010 California Uniform Fire Code as adopted in Santa Barbara County Code Chapter 15. DTSC mainly provides oversight at sites near schools, Brownfields reuse sites, and sites requiring emergency response that pose a public or environmental threat, but there are no solvent responsible parties. DTSC regulates hazardous waste in California primarily under the authority of the federal Resource Conservation and Recovery Act of 1976, and the California Health and Safety Code, similar to the Fire Department.

Through State laws and regulations the Water Board has authority to require submission of information, direct action, establish regulations, levy penalties, and bring legal action when necessary to protect water quality. Pursuant to the Porter-Cologne Water Quality Control Act (California Water Code, Division 7), Section 13267, the Water Board may require investigation

[11] County of Santa Barbara State Water Board Contract No. 11-015-250, renewed February 17, 2011.

[12] February 9, 1999 Santa Barbara County Inter-Agency Coordination Agreement Regarding Oil Field/Lease Decommissioning/Restoration.

of the quality of any waters of the State within its region and, in doing so, may require the submittal of necessary technical reports. Furthermore, California Water Code Section 13304 provides that the Water Board may require cleanup of waste and abate the effects of a discharge or a threat of a discharge of waste into the waters of the State. Guidelines for site investigation and remediation are promulgated in State Board Resolution No. 92-49 entitled *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*[13].

Cost Recovery Program

Contaminated sites must be evaluated and remediated by the responsible parties (who typically are past operators of a site, past property owners, or current property owners). Responsible parties enroll in a cost recovery program, and reimburse regulatory agency for staff time related to their oversight. Regulatory staff must therefore work and bill their hours directly to sites, and have limited resources to work on projects that are not funded by a responsible party. Approval of this project will allow staff to evaluate water quality from a broader view point to better assess how shallow aquifer pollution poses a risk to human health, drinking water supplies, surface water, and the environment in the Santa Barbara area. To effectively prioritize cleanup efforts, the contribution of contamination from each site needs to be understood as it relates to the groundwater basin as a whole. Currently, regulatory agencies are limited by their funding structure and therefore their efforts focus on individual sites. This grant would allow the regulatory agencies to evaluate cleanup efforts from a groundwater basin viewpoint.

GeoTracker

GeoTracker is the Water Board's data management system for managing sites that impact groundwater, especially those that require groundwater cleanup. GeoTracker's public and secure portals retrieve records and view integrated data sets from multiple State Water programs and other agencies through an easy-to-use Google maps GIS interface that allows users to view data in relationship to streets/roads, satellite imagery, and terrain map views as well as other sites that affect groundwater quality. GeoTracker is the largest receiving system nationally for analytical and field data for cleanup sites. Dischargers and regulatory case workers upload electronic copies (PDF format) of reports and documents, and laboratories directly upload analytical results. GeoTracker can be used to track regulatory information and it also shows cleanup site and monitoring well locations on Google maps. GeoTracker is a very useful tool and the public and other agencies can use GeoTracker to quickly review environmental conditions at any site. Regulatory staff use it daily to manage site data and their overall work load. Additionally, GeoTracker is set up to evaluate overall performance of the cleanup programs. GeoTracker also links to EnviroStor, which is DTSC's GeoTracker equivalent database.

Responsible parties have been required to upload their data (including reports and monitoring wells data) to GeoTracker since 2005 in accordance with Title 23. GeoTracker does not contain complete historical files for all sites as many files have not been converted from hard copy to electronic files. Additionally, the Fire Department does not have the resources to upload or confirm all non-UST cleanup sites are uploaded to GeoTracker; many cases are not yet in the system, or the uploaded data is not complete. This project would provide much needed additional resources to confirm all sites are adequately uploaded and reconcile files contained in multiple regulatory agency offices. A compilation and complete record of available data will

[13] State Water Board. Resolution No. 92-49. As Amended on April 21, 1994, and October 2, 1996. http://www.waterboards.ca.gov/water_issues/programs/land_disposal/resolution_92_49.shtml

benefit all stakeholders including state and local agencies that deal with water quality and land use issues.

GeoTracker GAMA

The GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA)[14] program builds on GeoTracker and is an online groundwater information system that gives access to water quality data and connects interested stakeholders to groundwater basics and protection information. GeoTracker GAMA currently integrates data from State and Regional Water Boards, California Department of Public Health, Department of Pesticide Regulation, Department of Water Resources, US Geological Survey, and Lawrence Livermore National Laboratory. This online database integrates groundwater quality data from multiple sources, which are searchable by chemical or location with results displayed on an interactive Google maps interface.

Currently, regulatory agencies do not have a method to store and share data or reports electronically that are not site-specific. GeoTracker is currently set up to provide information specific to a cleanup site. This project will create a comprehensive bibliography, electronic library, and to the extent feasible, a relational database containing non-site related data and reports (e.g., City monitoring well data, USGS evaluations, water management plans, etc.) GeoTracker GAMA could be used to house reports and information related to basins, but additional work needs to be conducted to determine if this is feasible. The goal of this project is to create a repository for the non-site related information that is accessible to interested stakeholders.

Existing Information Regarding Soil and Groundwater Pollution

There are over 300 open and closed cleanup sites in Santa Barbara, each are labeled as squares as shown on Figure 7. Over 160 of those sites have been closed, and these sites are shown with an "X" in the square. Within the project area, which is generally the downtown area, the Fire Department is working on about 65 active UST sites (shown in red), and the Fire Department and the Water Board are working on about 40 non-UST sites (shown in green). DTSC (sites labeled with a triangle) oversees about five active sites, but has about five inactive sites that need further evaluation.

In Santa Barbara, many of the sites the Water Board oversees include dry cleaners, that are contaminated with chlorinated VOCs (CVOCs), including tetrachloroethylene (PCE), trichloroethylene (TCE), and their breakdown products. In the second quarter of 2012, some of the highest concentrations of PCE and TCE were 9,200 micrograms per liter (µg/L) at Mission Linen/Ambassador Laundry (E. Haley Street) and TCE at 21,000 µg/L at Tecknit/Tube Holding (Nopal Street), respectively. For reference, the drinking water quality objective for both PCE and TCE is 5.0 µg/L. Typically, the UST sites are impacted with TPH, benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether (MTBE), other fuel oxygenates, 1,2-dichloroethane (a.k.a. ethylene dichloride or EDC), and/or lead. The highest concentrations within the previous year (June 2011 to July 2012) at these UST Sites were about 578,530 µg/L gasoline range organics; 47,000 µg/L benzene; 9,000 µg/L MTBE; and 1,540 µg/L EDC. For reference, the Fire Department uses 1,000 µg/L as a screening level for gasoline range organics; and the MCLs for benzene, MTBE, and EDC are 1.0 µg/L, 5.0 µg/L, and 0.5 µg/L, respectively.

[14] Website is available here: http://geotracker.waterboards.ca.gov/gama/

Additionally, there are numerous independent Phase I and Phase II Environmental Assessment Reports completed annually that are often submitted to the Fire Department. Additionally, both City Fire and County Fire respond regularly to releases of hazardous materials that are not necessarily assessed nor remediated to clean-up standards, and may or may not be tracked to determine their impact to groundwater resources.

Monitoring data at the existing, active sites has demonstrated that plumes of groundwater contamination do not extend deeper than the SZ aquifer. However, few wells are screened greater than 75 feet below ground surface in this aquifer. Limited information is available to determine the transmissivity between the SZ and UPZ, and how pollutants from the shallow aquifer may transport to the drinking water aquifer. In the past, samples from a municipal supply well near one of the Water Board's cleanup sites did have detectable concentrations of PCE, so migration of shallow aquifer pollution to the drinking water is a real concern.

Site Prioritization

The intent of this project is to develop a strategy to ensure regulatory agencies clean up contaminated sites as efficiently and effectively as possible to better protect drinking water resources, human health, and the environment. This project will develop specific criteria that can be used to rank cleanup sites to ensure regulatory agencies are spending their resources on the highest priority work (greatest threat to human health and the environment). Four primary site ranking elements are considered: Risk to Human Health and the Environment, Site and Waste Complexity, Technical and Economic Feasibility, and Public Participation. Risk to human health and the environment relates to real or threatened impacts to human health and ecological receptors, including surface water and groundwater beneficial uses. Site and waste complexity relates to site and waste conditions, including (but not limited to) beneficial water uses, geology, hydrogeology, topography, soil type, waste types, plume characteristics, land use, proximity to receptor, etc. Technical and Economic Feasibility considers whether the cleanup is technically doable and if funding for the cleanup is reasonable, Public Participation considers the number and degree people are impacted, as well as the amount of interest and concern the case presents. Political and social interests should be considered in this ranking element.

Toxicity of Wastes

Currently, there is no comprehensive list describing the existing contamination in the Santa Barbara area. This study will develop a list of pollutants of concern, and compare pollutant concentrations to human health and ecological screening values. UST cleanup sites typically contain TPH, and associated gasoline related products including MTBE; BTEX compounds; and lead. Non-UST sites, or SMU sites, (e.g. former dry cleaners, manufacturing business, etc.) contain CVOCs including PCE and TCE. These pollutants may pose potential threats to human health and safety, and the environment. Many VOCs, CVOCs, and lead are known or suspected carcinogens.[15] Understanding which pollutants of concern pose the greatest risk based on available screening levels will focus the study on the highest risk pollutants.

Regulatory staff use environmental screening levels, which are conservative risk values published by various agencies to initially screen sites. Often the soil screening values are used as cleanup goals, in lieu of a discharger performing a site-specific risk assessment. Regulatory staff typically compare and use the following risk-based screening levels: Water Board's

[15] OEHHA Proposition 65 website. http://oehha.ca.gov/prop65/prop65_list/files/P65single062212.pdf

published Environmental Screening Levels (ESLs),[16] Cal-EPA's California Human Screening Levels (CHHSLs)[17], and EPA's Regional Screening Levels.[18] In addition to soil and groundwater screening levels, CHHSLs and ESLs include soil vapor and indoor air screening levels for many VOCs and CVOCs.

In order to evaluate groundwater impacts, regulatory staff compares groundwater concentrations to drinking water standards, or maximum contaminant levels (MCLs). MCLs are established by the California Department of Public Health (DPH) and are found in Title 22 of the California Code of Regulations.[19] Surface water standards, including aquatic life thresholds, along with the MCLs are summarized in the Water Board's ESLs. Typically, the aquatic life standards are greater than drinking water standards. However, Water Board Resolution No. 92-49 requires sites to ultimately cleanup to background concentrations, and the highest concentration the cleanup goal can be is the lowest (most protective) water quality objective. Therefore, little consideration is normally given to standards other than drinking water standards.

Conceptual Site Models

Regulators overseeing cleanup activities, regularly use assessment site tools to evaluate risk at individual sites. Due to its funding through the cost recovery program, regulators assess sites individually, and rarely have the resources to look at sites at a groundwater basin scale. Below is an example of a conceptual site model that regulators use in evaluating risk, pollutant sources, pathways, and receptors. For this project, a simplified conceptual site model will be developed for the basin as a whole, much like the model in Figure 8 Conceptual Site Model. Prior to developing the conceptual model, data collection will be required to identify exposure pathways and receptors, pollutants, hydrogeologic, and geologic characteristics of the groundwater basin.

Conceptual site models aid in the evaluation and cleanup of sites, as shown in Figure 9 Role of the Conceptual Site Model below. Specifically, the regulatory agencies will use this tool to rank cleanup sites and determine data gaps. Additionally, regulatory agencies will share this model with the City to help them manage and evaluate their receptors that may be at risk, including their drinking water aquifer and surface water. Additionally, this simplified approach can be used by responsible parties to ensure their sites are properly assessed to protect all pathways and receptors.

Receptors and Pathways

Regulatory agencies are already aware of the potential receptors in Santa Barbara, mainly the (1) drinking water aquifer, (2) surface water, and (3) direct expose to construction workers or occupants in buildings overlying contaminated soil and/or groundwater.

As described in the Water Resources section above, the City depends on groundwater resources to augment its primary surface water supplies, especially during drought. The connection between the shallow and deep aquifers is generally not known by dischargers, and not appropriately referenced in their reports. Additionally, regulatory agencies do not have all

[16] San Francisco Bay Water Board. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater Website, May 2008.. http://www.swrcb.ca.gov/rwqcb2/esl.shtml
[17] Cal-EPA. Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties, January 2005. http://www.calepa.ca.gov/brownfields/documents/2005/CHHSLsGuide.pdf
[18] EPA Regional Screening Levels Website, May 2012. http://www.epa.gov/region9/superfund/prg/
[19] http://www.cdph.ca.gov/certlic/drinkingwater/pages/chemicalcontaminants.aspx October 2011

the available data it needs to assess the pathway and receptor, other than data collected from active cleanup sites. This project would address these data gaps.

Regulatory agencies are not aware of sites that are currently impacting surface water within the downtown Santa Barbara area, although there are sites with best management practices in place to mitigate potential surface water impacts. However, the City has maps of their stormwater conveyance system and completed an evaluation to show the distance between plumes and the conveyance systems. This project would build on the evaluation conducted by the City to assess if there is a potential risk to surface waters from the stormwater conveyance systems, and identifying if additional data collection is needed.

Direct exposure must also be assessed as part of the conceptual site model. Direct exposure can occur during construction projects due to digging near soil contamination and/or from inhalation of volatile chemicals. Vapor intrusion is already being assessed at high concentration CVOC cleanup sites. In addition, City staff review many redevelopment projects, and some are on or near cleanup sites with volatile chemicals that may pose a threat to human health. This project will help facilitate coordination and sharing of data between City planners and cleanup regulatory staff. The City is currently working on a vapor barrier study as part of their General Plan update, titled Hazardous Materials Exposure Vapor Barrier Study. This Vapor Barrier Study includes conducting an engineering study on the use of vapor barriers as part of site development on properties next to or on top of sites with past or existing contamination to further protect against potential vapor intrusion from soil and groundwater. This project will build on and use data collected from the City's work and will also make information regarding VOC and CVOC sites regulated by Fire Department, Water Board, and DTSC more readily available to City planners and Building and Safety staff.

IRWMP

The Santa Barbara Countywide IRWMP describes the region's water management setting, history, challenges, goals, objectives, and strategies. The IRWMP promotes water management strategies to ensure reliable water supplies, improve water quality, and preserve drinking water resources. This project is in direct alignment with the goals of the countywide IRWMP. Two short-term (less than five years) regional priorities listed in the IRWMP include: 1) further define sources of groundwater contamination, and develop strategies to prevent contamination and improve quality in areas with known contamination; and 2) protect, restore, and enhance ecological processes in aquatic areas through water quality improvements; public education; restoration efforts, including removal of invasive species; and improved steelhead passage on strategic creeks.

Need for Comprehensive Evaluation

It is important to approve this project because pollution beneath urban areas poses unique challenges to regulatory agencies, the parties responsible for cleanup, and the general public including:

- Investigation and cleanup of waste is difficult or costly to perform beneath existing structures.
- Redevelopment or construction projects near or at contaminated sites requires extensive coordination, permitting, and review from multiple agencies before a project is approved; however, sharing data between agencies can be challenging, delaying projects. In addition the potential exists for redevelopment projects to be permitted without proper mitigation requirements if contamination data are not readily available.

- Occupants in overlying structures (residential and commercial) are more likely to be exposed to pollutants from vapor intrusion, and construction workers on properties can be exposed during digging.

Due to the density of sites, existing land use, and the potential for increased use of the underlying aquifer, additional evaluation needs to focus on the downtown and east side areas of the City of Santa Barbara to ensure protection of human health and the environment.

Project Description

Need for Project

For many years, the Santa Barbara County Fire Department (Hazardous Materials Unit), Central Coast Regional Water Quality Control Board (Water Board), and Department of Toxic substances Control (DTSC) have overseen the various elements of sites requiring soil and groundwater cleanup sites within Santa Barbara County, including the City of Santa Barbara. In the City's downtown area contamination has occurred from leaking underground storage tanks, former dry cleaner locations, industrial solvent release sites, manufactured gas plant sites and other unidentified sources. In fact, the downtown area of Santa Barbara has one of the densest occurrences of clean up sites in the Central Coast region. Regulatory agencies typically deal with cleanups on a case-by-case basis and currently there is no approach in place to evaluate cumulative effects of shallow groundwater pollution on the groundwater basin as a whole.

As our understanding of the risks posed by pollutants in shallow groundwater to human health (e.g., contaminated drinking water and vapor intrusion) and the environment has grown, the need for a more systematic response has become clearer. In the Santa Barbara area there are no efforts currently undertaken to identify where polluted shallow groundwater could reach deeper drinking water sources and where the basin is most vulnerable to pollutant migration. Additionally, if hydrogeologic conditions change (i.e., the City of Santa Barbara operates their municipal supply wells on a continuous basis during drought conditions) existing shallow groundwater contamination may migrate toward these wells, or downward through semi-confining zones. Groundwater pollutants may also reach creeks in Santa Barbara, potentially harming wildlife prior to discharging to the ocean. Therefore, there is a real need to understand the extent, characteristics, and risk posed by shallow polluted groundwater, even occurrences that may not have been discovered yet. In order to understand this risk it is necessary to understand the regional geology and hydrogeology, fate and transport of pollutants throughout the basin, and identify those areas that pose the highest risk to human health and the environment. This understanding will allow regulatory agencies to better prioritize the assessment and cleanup of the sites in close proximity to these high risk areas.

Goal

The goal of this project is to protect drinking water and surface water by prioritizing cleanup and closing sites that are polluting shallow groundwater. The goal would be achieved by meeting four objectives.

Objectives

The objectives discussed below are the basis of the tasks described in the Work Plan (Attachment 5)

Objective #1

Objective #1 is to develop a comprehensive database including all publically available information on polluted media (soil, groundwater, and surface water), hydrogeologic and geologic information, and fate and transport of waste constituents. Meeting this objective will result in acquisition, organization, and input of all water quality related data into GeoTracker to allow all agencies and stakeholders electronic access to available cleanup site data (e.g., pollutant concentration data, water levels, well logs, aquifer characteristics, aquifer test data, etc.) for the Santa Barbara Groundwater Basin. For the information that is not site or location specific, create a comprehensive bibliography, electronic library, and to the extent feasible, a relational database containing general groundwater information for the basin underlying

downtown Santa Barbara. Meeting this objective will require establishing a technical committee among agencies that manage issues related to water quality and developing a protocol for compiling water quality information for the downtown portion of the City of Santa Barbara.

Objective #2

Objective #2 is to identify the pollutants of concern and the risk these pollutants pose to the deep drinking water aquifer, surface water bodies, and public health. In meeting this objective a conceptual model of the groundwater basin based on existing information will be developed. The conceptual model will focus on fate and transport of pollutants in the downtown portion of the Santa Barbara groundwater basin.

Objective #3

Objective #3 is to develop appropriate prioritization criteria and identify the highest priority groundwater cleanup sites. Meeting this objective will ensure agency staff focus their efforts on those sites that pose the greatest risk to water quality and public health due to groundwater pollution.

Objective #4

Objective #4 is to assure ongoing monitoring is adequate to track existing pollution to document adequate cleanup efforts. This project will evaluate the existing monitoring efforts to identify any significant data gaps in existing monitoring and recommend modifications to the existing monitoring if needed.

Prioritizing cleanup efforts

The intent of this project is to more effectively cleanup sites in downtown Santa Barbara to better protect drinking water resources, human health, and the environment. This project will develop specific criteria that can be used to rank cleanup sites to ensure regulatory agencies are spending their resources on the highest priority work (greatest threat to human health and the environment). Three primary site ranking elements are considered: Risk to Human Health and the Environment, Site and Waste Complexity, and Public Participation.

The prioritization will rely on a conceptual model developed in collaboration with the other regulatory agencies and the City. The conceptual model will integrate both site specific and more general information incorporated into the database developed in the initial tasks of the project. The conceptual model will include pathways (transport) to sensitive receptors (such as groundwater) and the implications to public health.

Benefits

The project will have several benefits relating to protecting water supplies and reducing risk to the public and the local environment. These benefits and how they will be achieved are discussed below,

Water quality

The project will provide a primary benefit by protecting a major drinking water source from numerous and proximate sources of existing contamination. The benefit will be achieved by prioritizing pollution sources with highest risk to public health so as to focus source abatement and contamination cleanup. The agencies responsible for abatement and cleanup will collaborate in assessing cumulative risk of numerous existing contaminated sites through data sharing, risk assessment, and prioritization. The assessment and resulting cleanup program will be based on a systematic evaluation of all data sources including past site specific evaluations, water supply studies, infrastructure mapping, and monitoring. The benefit will be measured in

1) number of sites achieving closure, 2) decreasing trends in pollutant concentrations in monitoring wells (parts per million or parts per billion), and 3) improved surface water quality (parts per million or parts per billion).

Monitoring

The project will provide a secondary benefit by identifying gaps in existing monitoring programs and developing recommendations to improve existing surface and groundwater monitoring efforts. The benefit will be achieved by evaluating the ability of current monitoring to identify the extent of, and potential horizontal and vertical migration of contaminated groundwater ("plumes"). By identifying sensitive receptors (such as municipal supply wells and recharge areas), and pathways of migration, monitoring can be established in any critical locations. The agencies responsible for monitoring will collaborate in assessing current monitoring efforts based on the project's risk assessment and cleanup prioritization. Recommendations for monitoring program modifications will be provided in a written report. Data collected would be added to the project's databases to improve agency and public access. The benefit will be measured in 1) number of new monitoring wells, 2) areal coverage of monitoring wells, and 3) improved data compilation and management (percentage of data accessible to agencies and the public in a single database).

Water management

The project will provide a primary benefit by improving management of a major drinking water source. Currently, the City has a limited ability to incorporate risk from contaminated sites into their groundwater management strategy. The benefit will be achieved by identifying pollution sources with highest risk to public health and identifying pathways by which public water supply wells could be affected. The City can then use the assessment of risk from numerous existing contaminated sites to identify the optimum use of its existing groundwater resources. Results from ongoing monitoring will allow the City to make changes to management of its water supply based on results of ongoing cleanup activities. The benefit will be measured in 1) improved yield (measured in acre feet per year) from the City groundwater sources and 2) improved surface water quality measured in concentration of contaminants transported from shallow groundwater.

Research/planning

The project will provide a primary benefit by allowing agencies responsible for abatement and cleanup of contaminated sites to focus their program priorities on public risk based on a full understanding of pollutant sources and the fate and transport of pollutants. The benefit will be achieved by assessing cumulative risk of numerous existing contaminated sites through data sharing, risk assessment, and prioritization. This will result in prioritizing pollution sources with highest risk to public health so as to focus source abatement and contamination cleanup. The assessment and resulting cleanup program will be based on a systematic evaluation of all data sources including past site specific evaluations, water supply studies, infrastructure mapping, and monitoring. This systematic evaluation of risk based on cumulative knowledge is not achievable under the current regulatory and funding framework. The benefit will be measured in 1) number of sites achieving closure, 2) decreasing trends in pollutant concentrations monitoring wells (parts per million or parts per billion), and 3) improved surface water quality (parts per million or parts per billion).

Relationship to Groundwater Management Planning

The City has "Pueblo" water rights and retains full control of the groundwater resources beneath the City. The City manages the groundwater basin consistent with the City's Long-Term Water Supply Alternatives Analysis & Urban Water Management Plan (1991) and Urban Water

Management Plans developed in 2005 and updated in 2010. In the past, the City has determined that a Groundwater Management Plan has not been needed given their level of control and the current level of development. However, the City Public Works Department has included development of a Groundwater Management Plan in its proposed FY 2013-14 Work Plan; this grant would support and encourage their efforts.

This project is essential to development of a ground water management plan by the City of Santa Barbara. The City does not have access to either the site specific data regarding existing contamination nor has there been any integration of existing information that would allow definition of fate and transport of pollutants. Without this evaluation, the City has incomplete information regarding the risks associated with developing supplies from their groundwater basin.

Interagency Collaboration

The project will be managed by the Santa Barbara County Fire Department with collaboration of the Water Board, the DTSC, and the City of Santa Barbara. The project will allow the City of Santa Barbara to develop a meaningful Groundwater Management Plan through consideration of risk of water quality degradation as well as water availability.

The County Fire Department has worked closely with both the Water Board and DTSC for many years on site assessments and cleanup projects. The County and the City work closely on a wide range of water planning issues including water conservation, drought planning and stormwater quality. However, lack of resources has precluded a cumulative evaluation of risk of existing contaminated sites with respect to water supplies and surface water resources. With the funding requested through this application, this core group of agencies has the correct regulatory responsibilities and public safety interests, as well as archived data, to assure success of the project.

Stakeholder Involvement

The existing regulatory process and data management systems provide opportunities for the public and other stakeholder groups to monitoring cleanup and closure of sites within their community. This project will include two noticed public meetings to inform stakeholders about the intent and schedule of this project as well as its results. In addition, a key work product will be a publically accessible database containing site characteristics and monitoring results to enable the public to access and monitor more site assessment and site cleanup activities in their community. The databases will be based on GeoTracker and GeoTracker GAMA and include al data that meets the criteria of the project's QA/QC process.

ATTACHMENTS:

Figures

1) Project Location and Cleanup Sites
2) Location and general features of the Santa Barbara groundwater basin.
3) Zoning Designations, City of Santa Barbara General Plan
4) City of Santa Barbara Storm Water Conveyance System
5) Cross Section A to A'
6) Location of ground-water subbasins in the Santa Barbara area
7) GeoTracker map showing regulated sites
8) Example of Conceptual Site Model
9) Role of Conceptual Site Model

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